ECE 321 - Quiz #1 - Name _____

1) Give 6 equations which allow you to solve for the 6 unknown voltages. You do not need to solve.

- Assume ideal op-amps.
- Assume R = 1100 + 100*(your birth month) + (your birth day). For example, May 14th gives R = 1614.
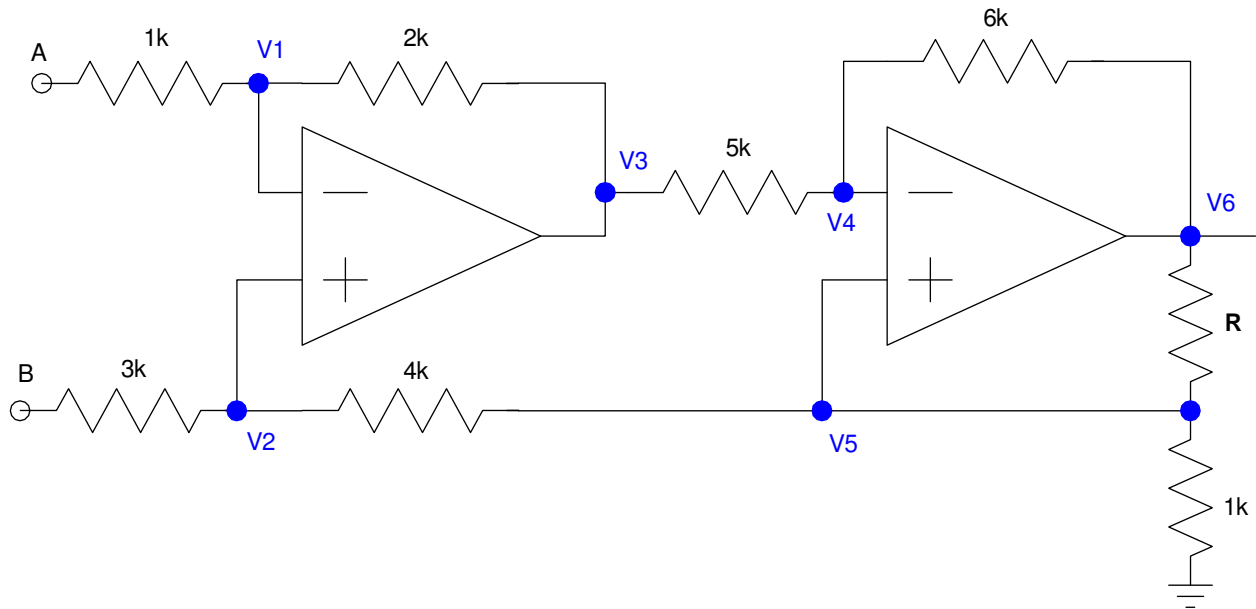
$$V_1 = V_2$$

$$V_4 = V_5$$

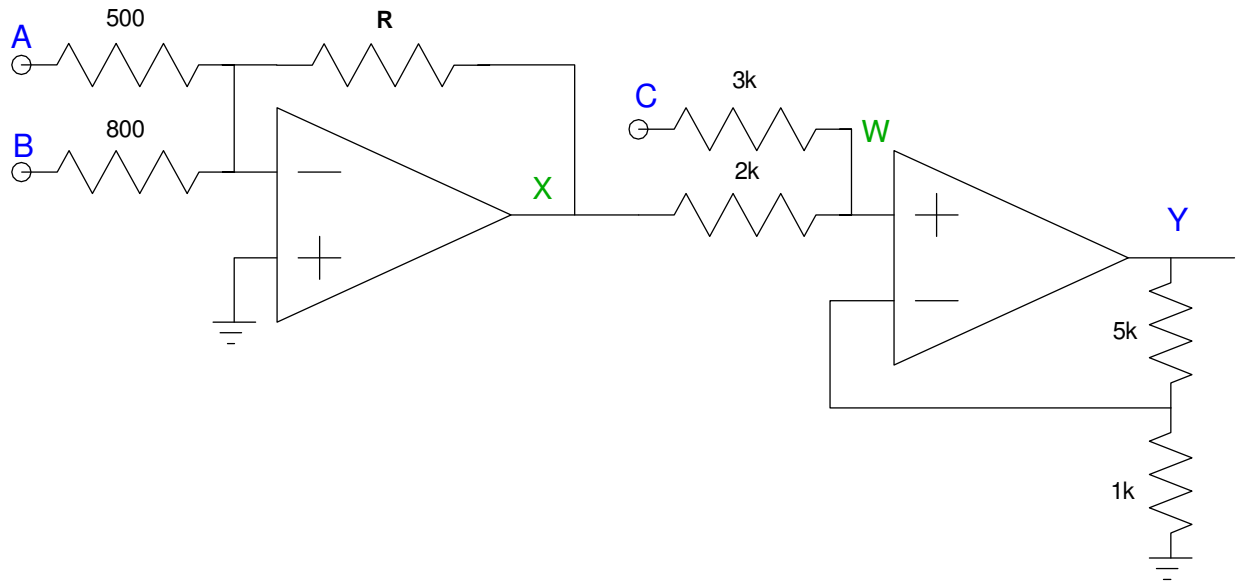$$\left(\frac{V_1 - A}{1k}\right) + \left(\frac{V_1 - V_3}{2k}\right) = 0$$

$$\left(\frac{V_2 - B}{3k}\right) + \left(\frac{V_2 - V_5}{4k}\right) = 0$$

$$\left(\frac{V_4 - V_3}{5k}\right) + \left(\frac{V_4 - V_6}{6k}\right) = 0$$

$$\left(\frac{V_5 - V_2}{4k}\right) + \left(\frac{V_5 - V_6}{R}\right) + \left(\frac{V_5}{1k}\right) = 0$$

2) Determine Y as a funciton of A, B, and C.

- Assume ideal op-amps
- Assume R = 1100 + 100*(your birth month) + (your birth day). For example, May 14th gives R = 1614.

R = 1614

$$X = -\left(\frac{1614}{500}\right)A - \left(\frac{1614}{800}\right)B$$

$$W = \left(\frac{2}{5}\right)C + \left(\frac{3}{5}\right)X$$

$$Y = 6W$$

Putting it all together

$$Y = 6\left(\left(\frac{2}{5}\right)C + \left(\frac{3}{5}\right)\left(\left(\frac{-1614}{500}\right)A + \left(\frac{-1614}{800}\right)B\right)\right)$$

$$Y = -11.62A - 7.26B + 2.40C$$

3) Design a circuit which outputs
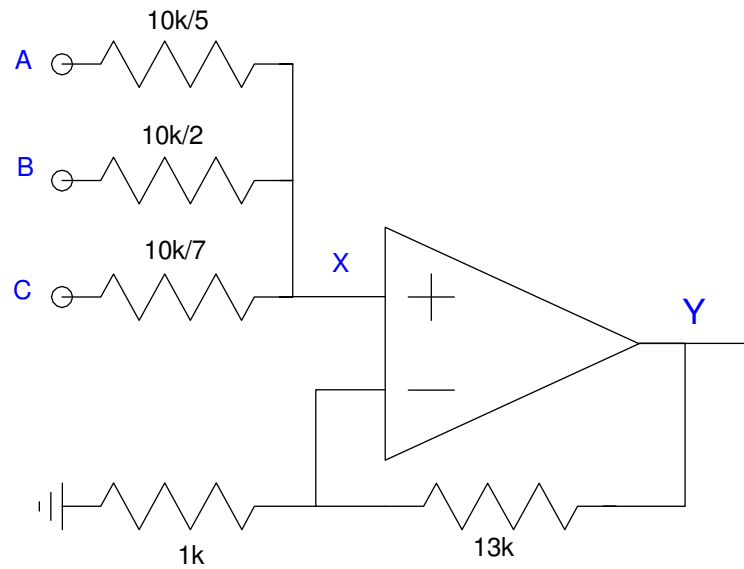
$$Y = 5A + 2B + 7C$$

note: the gain on C is positive

Create a voltage, X

$$X = \left(\frac{5A+2B+7C}{14} \right)$$

along with

$$Y = 14X$$

There are other solutions

4) Design a circuit which outputs

   Y = 5A + 2B - 7C
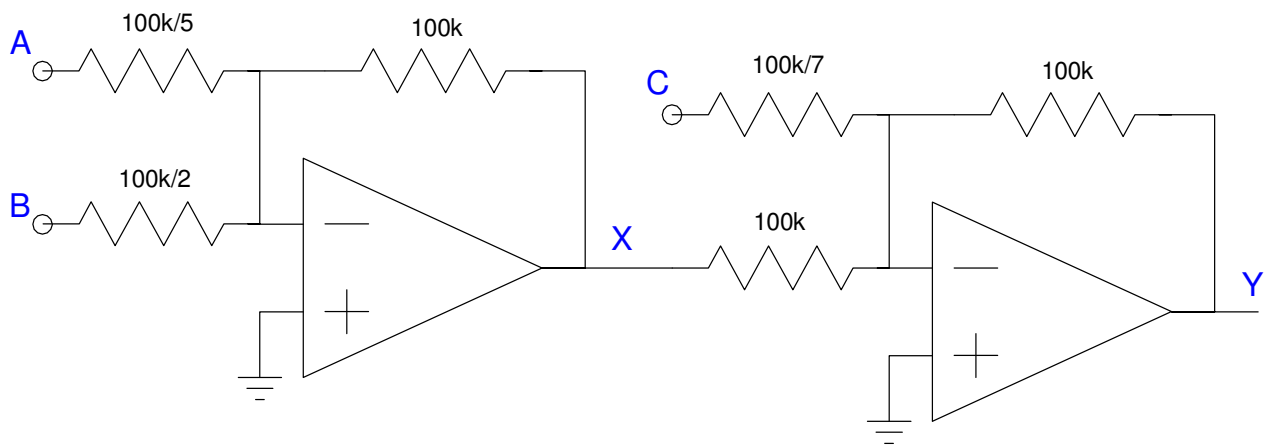
note: the gain on C is negative

One solution:

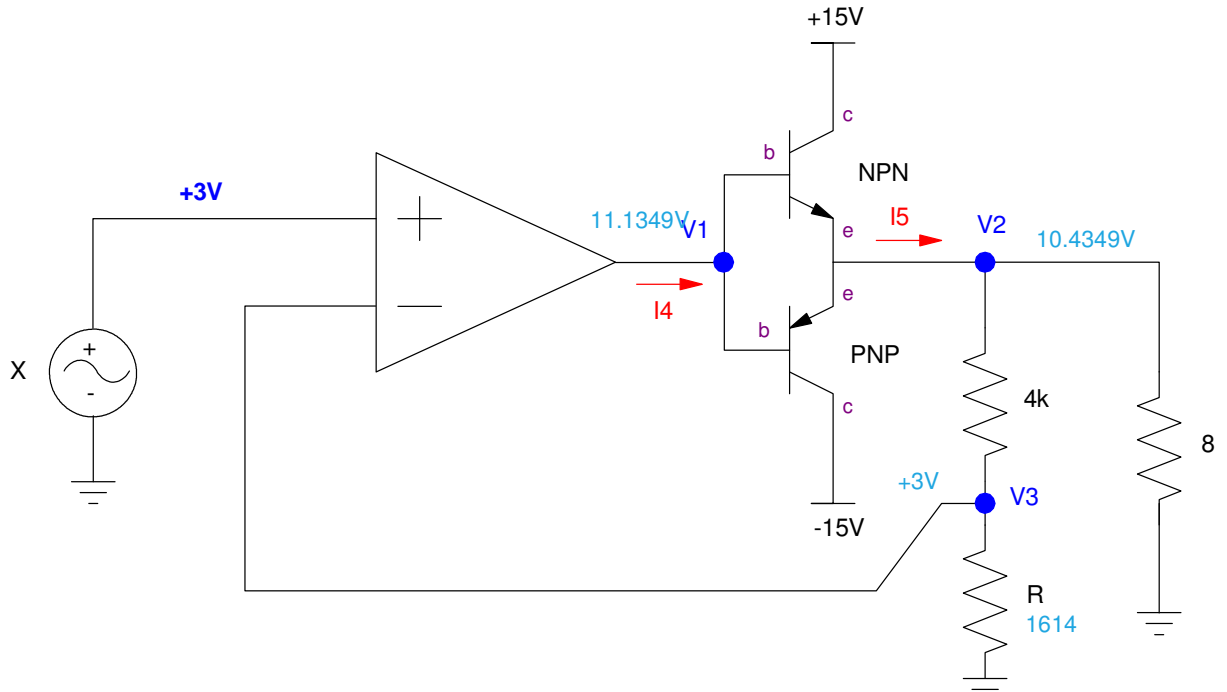Create a voltage, X

   X = -5A -2B

Y is then

   Y = -X - 7C

Use inverting amplifiers to implement each stage

5) Determine the voltages and currents for the following push-pull amlifier. Assume
- Ideal op-amps
- R = 1100 + 100*(your birth month) + (your birth day)
- TIP31 and TIP32 transistors:
    - β=200
    - $|V_{be}| = 0.7V$

R	V1	V2	V3	I4	I5
1100 + 100*mo + day					
1614	**11.1349V**	**10.4349**	**3.00V**	**6.498mA**	**1306mA**
	V2 + 0.7V	Y = (1 + R1/R2)*X	Vp = Vm	I5 / 201	

6) Determine the voltages and currents for the following push-pull amlifier. Assume
- Ideal op-amps
- R = 1100 + 100*(your birth month) + (your birth day)
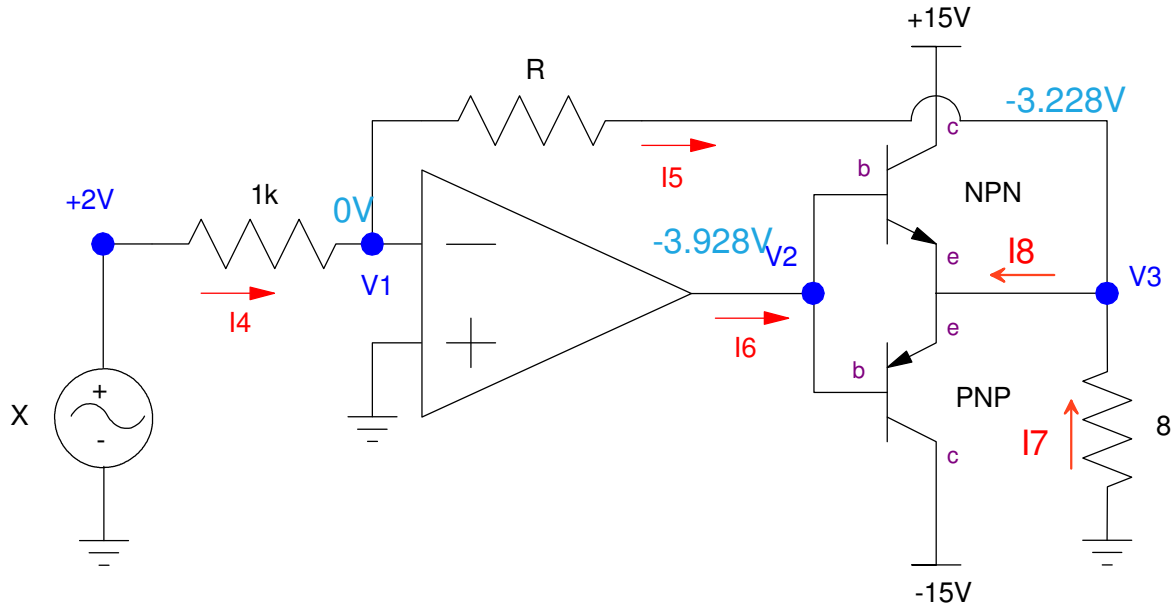- TIP31 and TIP32 transistors:
  - β=200
  - $|V_{be}| = 0.7V$

R 1100 + 100*mo + day	V1	V2	V3	I4	I5	I6
1614	**0V**	**-3.928V**	**-3.228V**	**2mA**	**2mA**	**-2.017mA**
	Vp = Vm	V3 - 0.7V	-(R/1k)*X		I5 = I4	

$$I_7 = \left(\frac{3.228V}{8\Omega} \right) = 403.5mA$$

$$I_8 = 2mA + 403.5mA = 405.5mA$$

$$I_6 = -\frac{I_8}{201} = -2.017mA$$